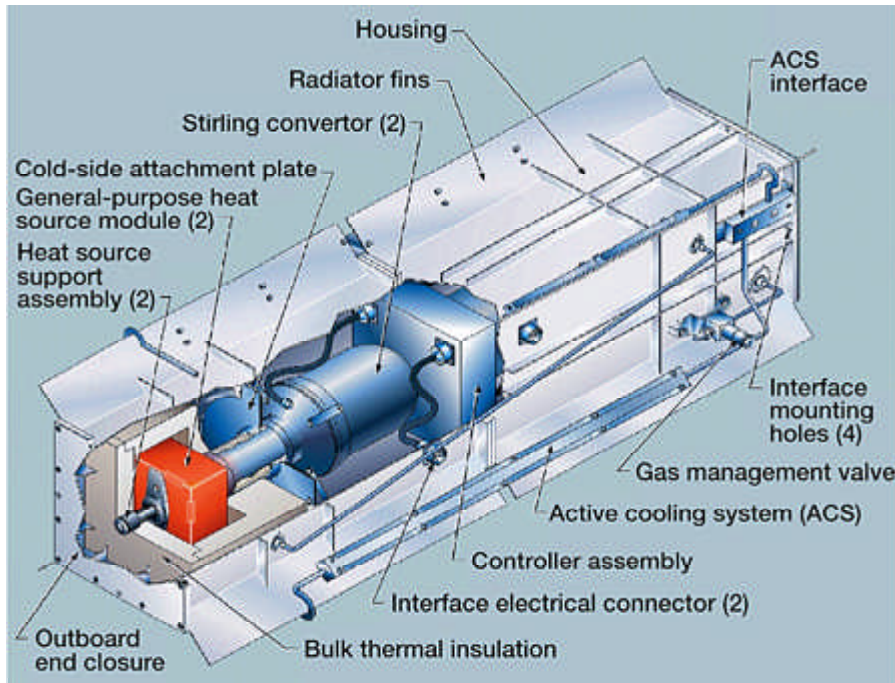


# Stirling Converter for the Stirling Radioisotope Generator Tested as a Prelude to Transition to Flight



*Conceptual design of the SRG by Lockheed Martin.*

Illustration showing heat source support assembly (2), general-purpose heat source module (2), cold-side attachment plate, Stirling convertor (2), radiator fins, housing, ACS interface, interface mounting holes (4), gas management valve, active cooling system (ACS), controller assembly, interface electrical connector (2), bulk thermal insulation, and outboard end closure.

The Stirling Radioisotope Generator (SRG) is currently being developed by Lockheed Martin Astronautics (Valley Forge, PA) under contract to the Department of Energy (Germantown, MD). In support of this project, the NASA Glenn Research Center has established a near-term technology effort to provide some of the critical data to ensure a successful transition to flight for what will be the first dynamic power system to be used in space. The generator will be a high-efficiency electric power source for potential use on NASA space science missions. The generator will be able to operate in the vacuum of deep space or in an atmosphere such as on the surface of Mars. High system efficiency is obtained through the use of free-piston Stirling power-conversion technology. The power output of the generator will be greater than 100 W at the beginning of life, with the slow decline in power being largely due to decay of the plutonium heat source. Previously, Glenn's supporting technology efforts focused only on the most critical technical issues.

Now, however, they have been expanded to cover a more comprehensive range of technical issues. The tasks include Stirling convertor and controller testing, materials evaluations, heater head life assessment, magnet aging characterization, linear alternator analysis, structural dynamics analysis, electro-magnetic interference and compatibility, organics evaluation, mechanical design evaluation, and reliability analysis.

Many of the tests conducted at Glenn use the 55-We Technology Demonstration Convertor (TDC) developed by the Stirling Technology Company (Kennewick, WA). There have been multiple controller tests that support the LMA flight controller design effort. Preparation is continuing for a system-level demonstration of TDC's operating in a thermal/vacuum environment. Recently, a pair of flight prototype TDC's were placed on an extended test with unattended, continuous operation. Heater head life assessment efforts continue, with the material data being refined, heater head structural testing beginning, and the analysis of life including more details of the integrated system. Long-term magnet aging tests are continuing to characterize any possible aging in the permanent magnets used in the linear alternator, including changes in magnetic strength or demagnetization resistance. The epoxy bond between the magnets and the stator lamination stock in the linear alternator is being evaluated in terms of lifetime and adhesion strength.

In a parallel effort, higher performance magnets are also being evaluated. A reliability effort is being initiated that will help to guide the development activities with a focus on the key components and subsystems. There is also an advanced technology effort that is complementary to the near-term technology effort.

## **Bibliography**

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**Find out more about this research:** <http://www.grc.nasa.gov/WWW/tmsb/stirling.html>

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